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IS 15707 (2006): Testing, evaluation, installation and maintenance of ac electricity meters - Code of practice  
[ETD 13: Equipment for Electrical Energy Measurement and Load Control]

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संस्थापन और रखरखाव — रीति संहिता

*Indian Standard*

TESTING, EVALUATION, INSTALLATION AND  
MAINTENANCE OF ac ELECTRICITY METERS —  
CODE OF PRACTICE

ICS 17.220.20

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## FOREWORD

This Code was adopted by the Bureau of Indian Standards, after the draft finalized by the Equipment for Electrical Energy Measurement and Load Control Sectional Committee had been approved by the Electrotechnical Division Council.

Though there are Indian Standards on electricity metering, need was felt for comprehensive information on the best practices in order to provide guidance to various stakeholders and electricity service providers responsible for not only testing, evaluation and installation of ac electricity meters at site, but also for maintenance of their metrological and functional performance. This Indian Standard in the form of a 'Code of Practice' addresses these issues. The objective of this Code is also to establish a performance based good meter asset management plan.

During the useful life of an electricity meter in open market, the following four categories of stakeholders have their specific roles to play in managing dependability of meter asset:

- a) *Electricity consumers* — set requirement targets;
- b) *Meter manufacturers* — provide design/reliability and metrological reports/data;
- c) *Notified bodies* — approve design, assign useful life, monitor quality, and set regulations; and
- d) *Metering service providers* — from purchase to disposal, through installation, removal and repair, with testing and calibration, optimally meet consumers' target at the centre stage of dependability management of meter asset within economical, regulatory and availability constraints.

In the background of this partnership based dependability management of meter asset, model recommendations for in-service compliance practices have been framed for protection of interest of the parties — consumers, electrical energy providers and metering service providers, but economical viability will depend on overall effectiveness of dependability regime.

This Code is applicable for both static and electromechanical meters. The considerations based on reliability prediction or accelerated reliability testing for assignment of useful life, are also applicable for both types of meters.

In case of any contradiction between a normative requirement of this Code and the Central Electricity Authority (Installation and Operation of Meters) Regulations under the *Electricity Act, 2003*, the requirement(s) of the regulations shall be decisive and binding. The corresponding clause(s) of this Code will then be treated as informative for good practices along with other informative clauses earmarked in the scope.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## *Indian Standard*

# TESTING, EVALUATION, INSTALLATION AND MAINTENANCE OF ac ELECTRICITY METERS — CODE OF PRACTICE

## 1 SCOPE

**1.1** This Code outlines informative requirements and good guidance as Code of practices to various stakeholders and service providers in metering industry responsible for maintaining metrological and functional performance throughout the long unattended period of useful life of ac electricity meters, covering their testing, evaluation, installation and maintenance. The objective is also to establish a performance based good meter asset management plan.

**1.2** This Code covers the following aspects:

- a) Type approval;
- b) Life certification;
- c) Verification;
- d) Sealing and seal management;
- e) Acceptance;
- f) Transportation;
- g) Storage;
- h) Installation and commissioning;
- j) Maintaining in-service with emphasis on in-service compliance; and
- k) Meter test station practices.

**1.3** This Code also deals with:

- a) Identification and removal of defects in reasonable time;
- b) Repair;
- c) Re-certification and re-verification; and
- d) Disposal.

**1.4** This Code covers Class 2.0, 1.0, 1.0 S and 0.5 S low, medium and high voltage meters rated up to 33 kV as per IS 13010, IS 13779 and IS 14697. In-service compliance testing of meters for low and medium voltage applications are generally carried out using statistical sampling techniques; so that metering providers may identify appropriate action plans for divergent meter populations. At present sampling by attributes has been preferred. High voltage meters may be subjected to 100 percent testing.

**1.5** The model recommendations and practices are given with special emphasis on:

- a) Correct and proper installations;
- b) In-service surveillance;
- c) Safety measures;
- d) Testing at various stages;
- e) Standards for meter testing and periodicity of calibration thereof;
- f) Concept of certified life;
- g) Requirements for in-service compliance testing; and
- h) Performance based meter asset register.

### NOTES

1 The attributes method of sampling has been considered in this Code.

2 Special requirements for Class 0.2 S extra high voltage meters have been excluded and will be considered later.

3 Presently there is no designated notified body in India responsible for type approval, life certification or verification sealing. Part of the verification function is covered under the BIS Certification Marks Scheme. Once a body is notified for type approval, life certification and verification sealing 4, 5, 6, 7 would become normative.

4 The reference to Electromechanical meters in this Code is for meters already installed.

**1.6** The following clauses of the Code are informative.

- 4 Type approval;
- 5 Life certification;
- 6 Verification;
- 7 Verification sealing;
- 11.3.3 Installation of instrument transformers;
- 11.6 Terminations; and
- 14 Recertification/Re-verification/In-service recompliance 14 (a) and 14 (b) only.

## 2 REFERENCES

The following standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
732 : 1989	Code of practice for electrical wiring installations ( <i>third revision</i> )
2500 (Part 1) : 2000/ ISO 2859-1 1999	Sampling inspection procedures: Part 1 Attribute sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection ( <i>third revision</i> )

IS No.	Title
2705	Current transformers: (Part 1) : 1992 General requirements (Part 2) : 1992 Measuring current transformers
3043 : 1987	Code of practice for earthing ( <i>first revision</i> )
3156	Voltage transformers: (Part 1) : 1992 General requirements ( <i>second revision</i> ) (Part 2) : 1992 Measuring voltage transformers ( <i>second revision</i> )
3961	Recommended current ratings for cables: (Part 1) : 1967 Paper insulated lead sheathed cables (Part 2) : 1967 PVC insulated and PVC sheathed heavy duty cables (Part 3) : 1968 Rubber insulated cables (Part 5) : 1968 PVC insulated light duty cables
4146 : 1983	Application guide for voltage transformers ( <i>first revision</i> )
4201 : 1983	Application guide for current transformers ( <i>first revision</i> )
5547 : 1983	Application guide for capacitor voltage transformers ( <i>first revision</i> )
8061 : 1976	Code of practice for design, installation and maintenance of service lines up to and including 650 V
11448 : 2000	Application guide for ac electricity meters ( <i>first revision</i> )
12346 : 1999	Testing equipment for ac electricity energy meters ( <i>first revision</i> )
13010 : 2002	ac Watt-hour meters, class 0.5, 1 and 2 — Specification ( <i>first revision</i> )
13779 : 1999	ac Static watt-hour meters, class 1 and 2 — Specification ( <i>first revision</i> )
14697 : 1999	ac Static transformer operated watt-hour and VAR-hour meters, class 0.2S, 0.5S and 1.0S — Specification
14772 : 2005	General requirements for enclosures for accessories for household and similar fixed electrical installations — Specification ( <i>first revision</i> )
IS/ISO/IEC 17025 : 1999	General requirements for the competence of testing and calibration laboratories ( <i>first revision</i> )

definitions shall apply, besides the definitions given in the referenced standards:

**3.1 Type Approval** — The initial part of a conformity assessment procedure whereby a notified body examines themselves or with the aid of an established meter testing laboratory, the technical design of a prototype meter and ensures and declares that the technical design denoted by the approved type meets with the requirements of the relevant standard(s).

**3.2 Verification** — The part of a conformity assessment procedure whereby a notified body ensures continuously or periodically the conformity of the production batches of meters to the approved type.

**3.3 Reference Standard** — A standard whose measurement traceability has been verified at an accredited laboratory and is used for in-house verification of other standards in the meter test station (M.T.S.).

**3.4 Transfer Standard** — ac/dc transfer standard and ac transfer standard of the meter test station (M.T.S.).

**3.5 Working Standard** — A standard including a complete meter testing system, which has been verified by comparison to either a reference standard or a transfer standard, and is used for calibration and testing of metering equipment.

**3.6 Mobile Standard** — A standard, that is, ac transfer standard or working standard, which is used for on-site testing of metering equipment.

**3.7 ac/dc Transfer Standard** — A standard which has been verified in comparison to ac and also dc standards of an accredited laboratory. It is also periodically verified in-house against dc standards and is used to verify ac transfer standards or working standards.

**3.8 ac Transfer Standard** — A standard which has been verified by comparison to either a reference standard or an ac/dc transfer standard, and is used for calibration and testing of metering equipment.

**3.9 Certification** — The part of a conformity assessment procedure whereby a notified body assigns and certifies the life of an approved type of meters.

**3.10 Useful Life** — The expected period in-service of an approved type of meter in compliance with the requirements of relevant standards and certified by a notified body prior to commencement of regular production. From the instant of initial installation, it is extended up to the instant when failure becomes too frequent so that repairing cannot be performed or it is economically not viable.

**NOTE** — Unless the life is extended by the notified body during use, the meters are taken out of service on expiry of life. Similarly if the life be reduced by the notified body during

### 3 TERMINOLOGY

For the purpose of this standard, the following

use, the meters are taken out of service on expiry of modified life.

**3.10.1 Minimum Life** — The minimum value of useful life for a particular category of meters set by a notified body for the purpose of certification and putting into service of meters of an approved type belonging to that category.

**3.11 Reliability** — The probability that a meter can maintain its metrological and functional capabilities as per relevant standards under given conditions of use for a given period.

**3.12 Dependability** — The collective form of the availability performance and its influencing factors: reliability performance, maintainability performance and maintenance support performance.

**3.13 Durability** — The ability of an item to perform a required function under given conditions of use and maintenance, until a limiting state is reached.

NOTE — A limiting state of an item may be characterized by the end of the useful life, unsuitability for any economic or technological reasons or other relevant factors.

**3.14 In-service Compliance Period** — The expected period in service of a particular population of meters in compliance with the requirements of relevant standards and generally assigned statistically by compliance inspection of the population.

NOTE — Initial compliance period may be gainfully used in the absence of a certified life of meters, as part of a performance based good asset management plan.

**3.15 Population** — A quantity of same type of in-service meters identified on the basis of similar characteristics for the purpose of carrying out compliance inspection as per this Code of practice by adopting generally statistical techniques.

**3.16 Sample** — Set of one or more items taken from a population and intended to provide information on the population.

**3.17 Inspection by Attributes** — Inspection whereby the item under inspection is classified as conforming or non-conforming with respect to a specified requirement(s).

**3.18 Inspection by Variables** — Inspection whereby a particular characteristic of each of the items under inspection is measured and recorded involving reference to a continuous scale.

**3.19 Acceptable Quality Level (AQL)** — The maximum percentage of defects of a given characteristic in a population, which can be considered satisfactory for the purpose of sampling inspection.

**3.20 Single Sampling Inspection Plan** — Sampling inspection in which the decision, according to a

specified criteria, to accept or reject a population is based on the inspection results obtained from a single sample of predetermined size and outlined in a specific plan.

**3.21 Error (of a Meter)** — The registered value of energy (as indicated by a meter) minus the true value of energy in a specified time.

NOTE — Since the true value cannot be determined, it is approximated by a value with a stated uncertainty that can be traced to national standards.

**3.22 Uncertainty** — An estimate attached to a test result which characterizes the range of values within which the true value is expected to lie.

**3.23 Limits of Error** — Values of error within which the metrological performance of a meter is required to be maintained or verified under reference conditions as specified by the relevant metering standards considering the measurement uncertainty of test results.

**3.24 Maximum Error In-service** — Maximum error measured for a meter in service under rated operating conditions.

NOTE — It is related to error under reference conditions with uncertainties due to measurement and in-service shift under operating conditions as specified in relevant standards (the latter part being calculated on root-mean-square-summation principle from specified variation of error due to individual influence quantities).

**3.25 Maximum Permissible Error In-service (M.P.E.)** — Extreme value of an error permitted by this Code or national regulations for a given meter in service under rated operating conditions as specified in relevant standards.

**3.26 Certification Sealing** — The process of affixing distinctive seal(s) on a meter as a mark of verification by a notified body and maintaining proper record for traceability of the asset and the appliance with which sealing has been performed. The purpose of sealing is also to provide security to meter elements and the register.

**3.27 Installation Sealing** — The process of affixing distinctive seal(s) on a meter, metering equipment and installation with the intent of creating evidence of unauthorized access to the metering system.

**3.28 Primary Packaging** — The packaging that immediately envelopes a product. It provides most of the strength and the moisture, vapour or grease barrier needed to safeguard the meter's performance and functionality from the time it leaves the suppliers site until its installation.

**3.29 Secondary Packaging** — The outer package into which the primary package is placed. Its major function is to protect the meters during shipping and distribution.

**3.30 Asset Register** — A registration system, electronic or otherwise, of metering assets of a licensee recording various details related to their procurement, usage, status of in-service compliance, repair, reuse and disposal for the purpose of traceability.

**3.31 Accredited Laboratory** — The laboratory for maintaining electrical energy standards and accredited as per IS/IEC/ISO 17025 in a national/international calibration chain traceable to primary S.I. standards.

## 4 TYPE APPROVAL

**4.0** The process of ascertaining the compliance of a meter type as per the relevant standard by a notified body is given below in brief.

### 4.1 Methodology

**4.1.1** The manner of type approval and the number of prototype samples are generally determined by the notified body. However, the samples are actually drawn and submitted by the manufacturer along with all necessary documentation with details as given:

- a) Type designation;
- b) Meter rating details;
- c) Drawing of nameplate;
- d) Metrological characteristics, including:
  - 1) Description of measuring principle;
  - 2) Metrological specification;
  - 3) Hardware adjustments, if any; and
- e) Technical specification, including:
  - 1) Block diagram with functional description of components and devices;
  - 2) Drawings, diagrams and general software information explaining the construction;
  - 3) Sealing arrangement and protective devices; and
  - 4) Data for dependability/durability characteristics for life estimation (including possible software aspects in future).

**4.1.2** Type approval is accorded by the notified body and a certificate is issued after:

- a) Type tests are satisfactorily performed;
- b) Type particulars as given in the documentation have been studied and recorded;
- c) Consistency of production feasibility has been examined and ensured based on manufacturer's report; and
- d) Minimum life has been ensured from dependability characteristics, which may be 10 years.

### 4.2 Validity of Approval

Generally the approvals shall be valid for a period of 10 years. For meters with certified life, it may continue till the end of useful life.

### 4.3 Amendment

In case of modification from the approved type, it will be reported by the manufacturer and a fresh type approval will be accorded on the basis of limited examination including limited type tests related to modification(s). The extent of testing shall be as decided by the type approval authority.

## 5 LIFE CERTIFICATION

**5.0** Assigning a useful life to an approved type of meters, usually by a notified body, is done on the basis of one of the following.

### 5.1 New Type of Meters

- a) By prediction of durability from estimated reliability of components furnished by the manufacturer in the design stage; and
- b) By accelerated durability testing of the prototypes.

### 5.2 Existing Type of Meters

- a) By collection of reliability data from field;
- b) By inspecting removed meters from the field; and
- c) By sample survey of meters in service as part of on-going compliance programme.

NOTE — Removed meters from the field inspected for the purpose of assigning useful life would not include damaged or tampered meters.

## 6 VERIFICATION

The process of verification is to provide high level of confidence among users as well as the energy service providers.

It covers the following objectives:

- a) Maintenance of a quality management system by the manufacturer for meters of the approved type with regular audit, and periodic surveillance by a notified body;
- b) Regular audit of meters awaiting dispatch after manufacture for metrological verification to show conformity to the approved type on the basis of statistical sampling by attributes with  $AQL = 1$ , and periodic surveillance of the manufacturer by a notified body;
- c) Periodic type testing on samples of the manufacturer drawn by a notified body on the

basis of a limited tests to prove conformity to the approved type; and

d) Metrological verification of the meter test equipments (M.T.Es) of the manufacturer as outlined in this Code.

NOTE — Bureau of Indian Standards (BIS) is operating BIS Certification Marks Scheme in accordance with the *BIS Act, 1986* and the Rules and Regulations made thereunder, which covers the above objectives to some extent. However, it is not the notified body.

## 7 VERIFICATION SEALING

7.1 One or more distinctive seal(s) are applied after production of a meter on behalf of the notified body as an evidence of certification/verification. Seals are:

- a) Generally applied by authorized representatives of the notified body. Such representatives can be members of the manufacturing company, but qualified by the notified body;
- b) Made of metal ferule and stainless steel wire to be affixed with a punch, plastic/ polycarbonate self-lock or adhesive sticker with hologram;
- c) Provided with alphanumeric characters typical of the manufacturer and a distinctive traceable number;
- d) Approved manufacturer specific alpha numeric characters are registered with the notified body; and
- e) Traceable with documentation as may be necessary.

## 8 ACCEPTANCE

8.1 The purchaser shall carry out acceptance of the meters offered for delivery by a supplier. The meters offered for acceptance shall be accompanied by test results as per the routine test schedule of the relevant metering standards duly signed by the manufacturer's quality assurance representative. The point of acceptance of goods may be supplier's premises, the buyer's premises, or any other premises as mutually agreed to between the purchaser and the supplier. This usually depends on the commercial nature of the contract, availability of appropriate acceptance testing facilities and logistics. In some cases, a staged acceptance process involving a pre-acceptance at supplier's premise followed by a final acceptance at the purchaser's premise may be adopted.

The acceptance test procedure will be overseen and certified by the purchaser's representative. The purchaser may choose to depute its own personnel, a third party or authorize the qualified personnel from the supplier organization itself.

The AQL for acceptance shall be 1.0 except for physical verification, ac voltage test, insulation resistance test and test for meter constant, which shall be carried out as per AQL 0.15.

Acceptance of meters shall be carried out either on 100 percent inspection basis or on sample inspection basis, as mutually agreed between supplier and purchaser. In case of inspection by sampling, it shall be carried out as per double sampling plan as given in Table 3A read in conjunction with Table 1 (for General inspection level II) of IS 2500 (Part 1).

The tests shall be as per the schedule of acceptance tests as specified in the relevant Indian Standards on metering, namely IS 13010, IS 13779 and IS 14697. Any additional test for physical and functional verification may be carried out as mutually agreed to between the supplier and the purchaser. Meter shall sealed by the manufacturer and shall be tested without breaking/opening manufacturer's distinctive (warranty) seal.

NOTE — For simultaneous testing of sealed meters with internal potential links, multi secondary voltage transformers (MSVT) or isolating voltage transformers (IVT)/isolating current transformers (ICT) of appropriate accuracy class should be used.

## 8.2 Inspection Reporting

The inspection observations report shall cover comprehensive information on serial numbers of the lot inspected, the lot size, the serial numbers of the sample meters, the date of inspection and the name of the person inspecting. The report shall carry categorical statement of observations and results of the tests mentioned in schedule of tests above. If any test is not done or waived off, the same shall be mentioned along with the reason thereof.

The lot shall be cleared by the designated authority based on the inspection report. In case of non-acceptance of the lot, the competent authority may take appropriate action.

## 9 PACKAGING AND TRANSPORTATION

### 9.1 Packaging of Meters

The meters shall be packed appropriately to ensure safe transportation, handling, identification and storage of meters from the manufacturer's premise to the installation site. All packaging material shall be environment friendly and in accordance with regulatory/environmental law or ruling. Use of non-recyclable material like polystyrene (thermocol) should be avoided.

9.1.1 The primary packaging of meters shall ensure protection against humidity, dust and grease and safeguard the meter's performance and functionality until its installation.

9.1.2 The secondary packaging of meters shall provide

protection during shipping and distribution. The following shall be ensured:

- a) Meters shall be packed in suitable packaging like corrugated cardboard cartons;
- b) Number of meters in each cardboard carton shall be determined by the convenience of handling;
- c) Packing cases shall indicate the fragile nature of the content and direction of placement of box. Each packaging shall clearly indicate the marking details (for example, manufacturer's name, serial numbers of meters in the package, quantity of meters, other details as agreed, etc) of the consignment as agreed between the supplier and the purchaser; and
- d) Additional packaging and marking requirements, if any, shall be as per mutual agreement between the purchaser and the supplier.

**9.1.3** The tertiary packing of meters shall ensure protection during shipment of meters. Appropriate measures shall be taken based on mode of transport, transportation distance, quantity and type of meters and geographical location of the consignee. Some transportation means may require specific packaging considerations (for example, pallet sizes, handling and lifting provisions).

## 9.2 Transportation of Meters

Care should be taken such that meters are not exposed to undue shock and mishandling during transportation. The stacking of the package boxes inside the transporting media should be such as to avoid their free movement inside. The packing should also be protected from rain and dust by the transport media.

# 10 INSPECTION AND STORAGE OF METERS

## 10.1 Inspection on Receipt

The inspection of received goods shall be carried out according to the sequence given in this Code. Records for proof of inspection shall be maintained. This procedure will be followed over and above the standard goods receipt practices of the user. The meters shall be inspected to ensure that the packaging is in compliance with 9. Additionally, it shall be verified that the documentation is commensurate with the contract and that there is no evidence of physical damage due to transportation, water seepage or pilferage. Evidence of any breakage, seepage of water, etc shall be reported to the competent authority for appropriate action.

## 10.2 Storage

### 10.2.1 Storage Conditions

The meters must be stored in a clean, dry and covered

place. The storeroom chosen for such storage should have proper ventilation and should be free from water seepage, dust, vermin and corrosive gases. The meters shall be stored on raised racks. Such racks should be easily accessible or approachable by the users.

Environmental conditions shall be maintained as given in Table 1.

**Table 1 Environmental Conditions for Storage**

SI No.	Influence Quantity	Permissible Limits		
		(1)	(2)	(3)
i)	Ambient temperature	As per relevant Indian Standard (see Note)		
ii)	Relative humidity	< 95 percent non condensing (limit for 30 days period)		
iii)	Altitude	< 5 000 m above MSL		

NOTE — As a good practice it is recommended to maintain storage temperature of 0°C to + 45°C.

## 10.2.2 Storage of Meters

The meters shall be stored with packaging may be primary or secondary packaging depending upon the need, limitations of the storage, quantity and expected duration of storage. The stacking of meters should not exceed the specified number as mutually agreed between the purchaser and the supplier. The stacking number should be marked on the packing and followed by the store personnel. The cartons should be placed according to the direction of placement of box and to allow easy accessibility with clear visibility of marking details. The cartons should preferably be arranged in serial order of meters for easy identification and retrieval.

Static energy meters shall not be stored for a period more than one year in de-energized (power off) conditions.

When a meter is stored for several months under extreme ambient conditions, it is likely that RTC may drift. It may be required to adjust the time of meters if the meters are provided with time adjustment facility. The maximum drift per annum permissible in the real time clock shall be as follows:

Meter Accuracy	Permissible Drift/Annum Max
0.2 S	± 2 min
0.5 S	± 5 min

## 10.3 Store Management

Proper records shall be maintained and all receipt and issue of material shall be recorded in the it. This also refers to the asset management process as detailed in 16.

#### 10.4 Pre-installation Inspection

It is the responsibility of the energy service provider to reasonably ensure that correct meters are installed at consumer premises. It should be verified that the manufacturer's distinctive seal is intact. Meters with broken/damaged seals should be returned to the manufacturer or sent to their authorized repair agency with defect report and suitably packed to avoid damage in transit. Such meters can be installed after repair and restoration (including calibration), resealing and submission of report by the manufacturer/authorized repair agency detailing action carried out.

A pre-installation inspection shall be carried out if;

- a) there is evidence of transit damage;
- b) more than six months have expired since the date of satisfactory acceptance inspection at manufacturer's facilities;
- c) storage conditions of the meter are not as per 10.2.1 and the temperature of storage has been beyond the limits of 0°C to + 45°C; and
- d) meters are directly purchased by the consumer; in which case the following shall be additionally verified:
  - 1) Meters meet the requirements of this Code,
  - 2) Meter is of a type, make and rating approved by the energy service provider, and
  - 3) Meter is accompanied by its user manual and routine test report duly certified by the manufacturer.

Records for inspection shall be maintained.

NOTE — Please also refer 10.2.2 for static meters fitted with real time clock (RTC).

The sample size and schedule of tests shall be as specified in 8. For meters directly purchased by the consumer, the sample size shall be 100 percent. The inspection report and clearance for installation shall be done as per 8.1.

### 11 PUTTING INTO SERVICE

#### 11.1 Meter Installation Classification

While laying down meter installation practices, it is important to recognize that installation practices need to be differentiated based on classification of meter. These classifications are based on:

- a) Meter type;
- b) Nature of application; and
- c) Location of the meter.

##### 11.1.1 Meters are of different accuracy classes used

for domestic, commercial and industrial purposes (see IS 11448). The different types of meters are as follows:

- a) Single phase direct connected meters;
- b) Three phase direct connected meters;
- c) Three phase CT connected meters; and
- d) Three phase meters for HV supplies (CT/VT connected meters).

#### 11.1.2 Metering Application

These shall be in accordance to *CEA Regulations* on installation and operation of meters.

#### 11.1.3 Location of the Meter (Based on Application)

The location of the meter shall be in accordance to *CEA Regulations* on installation and operation of meters. In case of indoor installation at consumer premises, the focus of installation practices for tariff meter is preventing misuse and deterring tampering or bypassing of meter by the consumer by having:

- a) A visually traceable and joint free incoming cable or shrink wrapped sealed joints; and
- b) Having clearly visible and accessible seals that can be subjected to easy inspection.

#### 11.1.4 Factors Affecting Measurements

There are number of factors concerned with installation, which unless taken care of might affect the overall measurement system. These factors, particularly for 3 phase CT or VT connected meters are covered below. These factors, for CT/VT connected meters are:

- a) *Influence of VA burden* — Connected burden of both CT's and VT's as measured at terminals prior to installation. Connected burden should be measured and recorded and should match the working range of instrument transformer; and
- b) *Influence of CT and VT wires*.

In CT connected meters and CT and VT connected HV meter installations the CT wire size and length, length and cross-section of VT wires play a major role in measurement accuracy. Voltage drops in VT wires causes an error which can be as large as 1 percent or more in energy recording and all extra investment for high accuracy meters and VT's is undermined by the VT cables. Connected burden should be measured, recorded and shall match with the working range of the instrument transformers.

#### 11.2 Issuance for Site Installation

##### 11.2.1 Selection of Meters

The meters have to be selected based on the consumer load.

### 11.2.2 Preparation of Meters

Meters have to be prepared as per the requirement of the service provider and the type of installation. Such preparatory activities are likely to include security sealing, record keeping, installation specific marking and bar coding, time setting, configuration change including TOD register setting, demand period setting, load survey setting, etc.

### 11.2.3 Issue of Meters and Record Keeping

The life cycle history of meters shall be traceable from the point of first installation. For this purpose an asset register shall be maintained in accordance with 16.1. Similarly, records related to sealing should be traceable and maintained by the sealing management system in accordance with 16.2.

### 11.2.4 Packing and Transportation

Meters shall be transported from the stores to the installation site suitably with proper care so as to prevent any damage or degradation of performance. During transportation, care shall be taken to protect meters from rainwater, dust and heat. The meters shall be transported in their own primary/secondary packing. In case of any transportation damage, meter shall not be installed and reported back to the appropriate authority.

## 11.3 Site Preparation

### 11.3.1 Selection of Site

Unless specifically intended for outdoor installation, metering system shall be installed indoors. The site shall be accessible to the consumer as well as service provider's personnel for meter reading, installation inspection and maintenance as the case may be. The meters should not be located in inaccessible private areas, or areas that are unsafe, inconvenient or unsuitable for entry by service personnel or an area with uncontrolled or unrestrained access to animals etc. The following shall be considered for selection of site and installation of meters:

- a) Metering installation shall be protected from excessive dust and moisture, exposure to direct sunlight, rain and water seepage and vermin. The site temperature should be within the limits of 0°C to +50°C. It should not be in proximity of machineries, heating devices, equipment generating high vibration or magnetic fields and areas prone to fire and toxic hazards;
- b) Meters should not be located at an elevated area or a depressed area that does not have access by means of a stairway of normal rise. The height of meter display shall be between

750 mm and 1 800 mm. In case the meter is provided with a secondary display unit, this requirement applies to the secondary display unit only;

- c) A minimum clearance of 50 mm should be maintained around the meter itself for better inspection. This includes the space between two meters, between meter and the mounting box and between two mounting boxes as the case may be; and
- d) Additionally, for outdoor installations, the meters shall be protected by appropriate enclosure of level of protection IP 55 and ensuring compliance with above conditions. The enclosure should preferably be light coloured.

### 11.3.2 Selection of Instrument Transformers (Wherever Applicable)

Reference can be drawn from IS 4201, IS 4146, IS 5547 and IS 11448.

Metering units shall use instrument transformers rated for metering use only. In no case, protection-core instrument transformers shall be used for metering.

The primary rating of the current transformers shall match with the load current requirement as per the contract demand. The secondary current and voltage rating of the instrument transformers shall match with that of the meter.

See 5.7 of IS 11448 for guidelines on selection of instrument transformers. However, when the meters are provided with external instrument transformer compensation features, the accuracy classes of the CT/ VT may be a class lower than that recommended.

For bulk energy transfer points, whether at consumer end or at interface points; it is recommended to use meters with instrument transformer error compensation features to ensure overall accuracy of the metering system.

VA rating of instrument transformers shall match the VA burden at its terminals including the burden of the meter. In case the actual burden presented at the instrument transformer terminals is less than 25 percent its rated burden; additional burden shall be connected to keep the overall burden within 25 percent to 80 percent of the rated burden.

When CT operated meters with built in neutral current measuring devices are used for the purpose of tamper detection, the service provider shall use a CT in the neutral circuit as well. The rating of the neutral circuit CT should be identical to the CT's on the phases.

### 11.3.3 Installation of Instrument Transformers

Instrument transformer installations should be such as

to ensure protection from tampering and maintenance of overall measurement accuracy. The following considerations are relevant.

#### 11.3.3.1 *HV consumers up to 33 kV*

All HV installations should ensure appropriate level of safety and protection from tampering.

The cable terminations should be secured from tampering by sealing, with the seals visible from outside. The routing of the cables should be clearly visible and bare conductors close to terminations should be insulated.

#### 11.3.3.2 *LV consumers*

Metering cubicles for systems using LV Current Transformers shall be manufactured as a whole unit to incorporate both the CTs and metering unit. The cubicles may be compartmentalized for CTs and the meter. Neutral current measuring CT shall be provided with transformer operated LV meters having neutral current measurement for current circuit tamper detection.

In case, a separate CT unit is used, the secondary cables of the CTs shall be run through conduits and well protected from tampering. The CT secondary wires should be as short as possible to keep the burden to a minimum. In order to avoid joints in the main cables, thread-through arrangement may be used with window type or base mounted CTs. Alternately, meters with thread through arrangement may be used. The window size of the CTs shall be so designed as to accommodate at least double the size of the aluminium conductor cable for the maximum current rating of the CT.

In order to prevent tampering with CT connections, it is recommended to use block CT's that terminate directly on to the meter, thereby making the CT secondary practically inaccessible. Alternately, thread through meters with integrated CT's may be used. In case of non-thread through type of CT units (bar type or bus bar type), where CT units need to be inserted in series with the load cable, the cable shall be terminated properly at both ends of the bus bar with proper lugs.

#### 11.3.4 *Distribution Transformer Metering*

Distribution transformer metering systems should be mounted at safe heights making unauthorized access difficult. It is recommended to use meters with wireless communication for this purpose. Metering units shall be designed to use minimum number of joints in the load circuit. The secondary cables of the CTs shall run through conduits and well protected from damage or weathering. It shall be ensured that the CT secondary conductors are not unnecessarily long and overburdening the CT. Wherever lugs are bolted to the bus-

bar or a terminal stud, the contact resistance shall be kept to a minimum and it should be ensured that the contact area is maximum. It is preferable to use meters with integrated CT's so that current terminations are not required at all. Proper bunching and systematic laying of wires shall be adopted for easy identification and maintenance. Appropriate methods shall be used for tapping the potential signal from the circuit.

#### 11.3.5 *Cabling*

The size of the service cable for direct connected meters shall be suitably selected to carry the current according to sanctioned load as per relevant part of IS 3961. Based on the length of the overhead cables, the galvanized iron support wire shall be used. The service cable shall be preferably armoured and such armour shall be earthed. For three phase 4 wire connections, usage of 4-core cables instead of 3½-core cables shall be preferred to reduce the possibility of burning of neutral cable under highly unbalanced conditions. It is recommended to install CT operated meter above 60A load.

Transformer operated meters shall be connected with minimum 2.5 mm<sup>2</sup> cables. Higher cross-sections should be used to ensure that the overall burden does not exceed the rated burden of the instrument transformer due to cabling. Appropriate colour coding shall be used for the cables appropriate to the various configurations like HV 3 phase 3 wire, 3 phase 4 wire or LV connections. Metering cables should be laid in mild steel pipe or conduits and there shall be no access to cables and their joints. Joints should altogether be eliminated in the metering conductors/cables and service cables. Type of cable used for meter installation should be multi strand cable for flexibility and ease of handling. Single cable length should be used for source side connection. There should be no joint in the cable till it is terminated on the meter. Above 50 A loads, flexible copper cable shall be used for termination on the meter.

#### 11.3.6 *Terminations*

- Appropriate crimping device shall be used for crimping the lugs. Thimbles shall be of appropriate configuration (pin type, fork type, etc) to match with the terminal block for low current connection. For high current terminations, crimping shall be used with cable crimping tools, and multiple point crimping shall be done for the lugs used for higher current ratings;
- If the terminal block is of MS cage clamp type, there is no need to use any lugs and the copper cables shall be directly terminated at the clamp;

- c) The recommended tightening torque must be exerted on the screw to ensure proper tightening of the terminations. It is recommended to use proper tools, equipments for this purpose;
- d) Usage of lugs as per the recommendation of manufacturer and ensuring proper crimping will protect the joints from failures;
- e) For high current terminations, tensile test and shock test shall be performed after crimping the lugs;
- f) Where, aluminium cable termination is to be done on copper bus bars or brass studs, bi-metallic type of lugs shall be used;
- g) Copper cables shall be used for the direct connected meters;
- h) For indoor meters, the wiring shall be done such that the cables enter the meter box from the bottom or rear side. This prevents the service cable from tampers etc;
- j) Use of test terminal block (TTB) is not recommended for LV metering. However they shall be used for HV metering; and
- k) Bi-metallic lugs shall be used wherever required.

#### 11.3.7 Mounting of Meters

Meters should be mounted such that they can not be easily dismounted and the wiring termination is not accessible without breaking a seal.

Additionally, special care should be taken to ensure that the electromechanical meters are mounted within  $\pm 0.5^\circ$  of the gravitational vertical using the triangular mounting arrangement i.e. one hanging hole at the top and two fixing hole on the opposite side of the terminal block provided on the meter. Further, according to footprints size/triangular mounting arrangement available for various make of meters a template for footprints should be prepared to mark position of correct hole for installing the meter vertical. The template should made of a heavy metal plate in such a way that verticality is ensured by its own weight. The template should be hanged on the top screw so that it can take normal vertical position for marking correct holes. Multiple meter footprints can be marked on the same metal plate. Alternately a plumb bob (to mark a vertical line prior to installation) or spirit level (on the top horizontal surface of meter to accurately identify the bottom fixing hole position) can be used for the purpose of installation.

#### 11.3.8 Installation Site Earthing

The energy service provider shall provide the earthing connection to the consumer in accordance to the *Indian Electricity Rules, 1956* at the metering point. The

earthing shall have continuous connection with the earthing pit of the transformer. The service provider shall maintain the earth resistance as prescribed in IS 3043.

MV and HV consumers shall additionally provide earthing connection from a local earthing pit as per standard practices and guidelines. Multiple earthing, grid earthing or single point earthing may be provided based on the supply system and fault level.

The earthing connection shall not be used as return conductor and shall not carry neutral current. The consumer earth and supply neutral should not be connected in the consumer premises after the metering point.

#### NOTES

- 1 There is a tendency to use water supply pipe line or exposed iron structure as earthing terminal. This shall be strictly avoided and no electrical circuit shall be connected to these metallic structures.
- 2 All the earth terminals of appliances, equipment, machines etc, shall be terminated to the consumer earthing point only.
- 3 Lightening strip shall not be used as earthing terminal.

#### 11.3.9 Meter Wiring and Connections

The service provider shall provide phase(s), neutral and earth connection to the consumers. The service provider shall provide separate neutral to each consumer up to the metering point and same shall be used by the consumer. Wherever there is multiple meter installations, busbar arrangement shall be used for neutral, so that looping is avoided.

The neutral shall be used for carrying return current only. The neutral of one consumer shall not be connected to other consumers who have independent and separate supply connection. The consumer shall ensure all the correct wiring practices are followed and neutral is not looped with another consumer or meters in the same premises. Consumer shall not earth the neutral after the metering point.

Relevant Indian Standards may be referred for wiring diagrams for meters.

##### 11.3.9.1 Supply side wiring

The supply side wiring is the responsibility of the service provider and following shall be ensured:

- a) Supply wires provided are of suitable rating as per the relevant part of IS 3961;
- b) When a number of meters are connected to a single distributing mains for registering electricity supplied to different consumer loads, separate service lines — phase(s) and neutral, shall be used for each meter. Each independently metered consumer load must be directly connected to distributing mains

through its meter connected in specified phase sequence so as to meet accuracy requirements of this Code;

- c) Supply wire shall be properly terminated;
- d) Connection shall be as per connection diagram mentioned on meter as per relevant metering standard;
- e) Service provider shall use its own earthing for its devices; and
- f) Utility shall ensure that the capacitor used for power factor shall be used with proper filter circuit to avoid generation of harmonics.

#### 11.3.9.2 Consumer side wiring

The consumer shall ensure proper wiring and shall get this wiring certified from a competent authority such as a licensed electrical contractor. It shall be ensured that:

- a) Proper safety norms as per IS 732 are followed;
- b) Wiring system is capable of handling the consumer load;
- c) Suitable protection devices such as MCB/ Isolator/Fuse are used at the point of supply after the meter. Earth leakage protective devices are installed in accordance with the *Indian Electricity Rules*; and
- d) Provision of proper earthing for household appliances.

The wiring is totally isolated and not shared with other premises. Interconnection of phases or neutrals of loads connected to different meters are not permitted.

Consumer shall undertake to get any alteration in the connected load, wiring and protection system verified for its appropriateness by a competent authority. Energy service provider shall ensure that the capacitor for improvement of power factor when used shall be with proper filter circuit to avoid generation of harmonics. It shall be maintained properly and according to the load and need of improvement of the power factor.

#### 11.3.10 Guideline for Choice of Tamper Proof Meter Box

The meters should preferably be mounted in suitable enclosure and shall be sealed at multiple points. The meters shall be mounted within specified permissible inclination as specified in relevant IS. There shall be no access to the meters without breaking the sealing arrangement (see IS 14772). Window shall be provided in the box to see the meter reading.

### 11.4 Meter Connections

#### 11.4.1 Verification of Connections

Following should be verified after installation of the metering system:

- a) Phase association;
- b) CT polarity;
- c) VT polarity;
- d) Phase angles;
- e) Phase sequence;
- f) System conditions and abnormal conditions such as unbalanced capacitors; and
- g) Actual CT/VT ratio (for transformer operated meters).

To achieve error free wiring, appropriate colour coding of wires shall be adopted.

The static meter should support instantaneous parameters capture by a measuring device through optical reading of the meters and the phasor diagram so obtained by reading the instantaneous parameters shall be verified at site for the above errors.

### 11.5 Commissioning of Meters and Reporting

- a) After any metering installation activity, a report shall be made by energy service provider and consumer or his representative shall verify the report;
- b) The report shall have all detail about new/old meter, sealing detail etc;
- c) If noticed, energy service provider shall inform consumer about any abnormal wiring at consumer end;
- d) Any floating neutral condition if noticed by the consumer should be brought to the notice of the energy service provider and same shall be resolved by the energy service provider; and
- e) Checks for phase-to-phase, phase to neutral up to the consumer main switch shall be carried out by energy service provider before switching on the load.

### 11.6 Security Sealing

Following sealing shall be ensured at time of meter installation:

- a) Manufacturer's meter seal;
- b) Service provider's meter seal;
- c) Terminal cover seal;
- d) TTB seals (where applicable);
- e) CT-VT seals;
- f) Meter box seal; and
- g) Sealing on cable joint box, etc.

There should be at least one seal at all point mentioned above (wherever applicable). The seal shall be tamper proof. The consumer shall be briefed about seals.

The seals shall be distinctive and follow the seal management system as per **16.2**.

## 12 MAINTAINING IN-SERVICE

### 12.1 In-service Testing

Metrological testing and functional verifications are carried out on meters in service as per requirement of relevant Indian standards:

- a) on receipt of consumer's complaint or internal report; and
- b) as part of in-service compliance inspection.

Methodology for in-service testing is as per **12.7**.

### 12.2 Methods of Testing

**12.2.0** Meter testing can be carried out on-site or at a meter test station, provided the test facility adopted complies with IS/ISO/IEC 17025. All test equipment shall be traceable to the National Standards. Meter for LV installation may be tested including CTs to get the overall accuracy of the meter. Meter and CT/PT for HV installation shall be tested separately.

#### 12.2.1 On-site testing may be carried out:

- a) under prevailing load, taking care that the load and power factor satisfy the range as indicated in Table 3;
- b) by injection method after connecting a suitable phantom load or external load. For reactive measurement, the test will be performed only by this method; and
- c) by installing off-line check meter — The meter of at least same or better accuracy class shall be installed for minimum one billing cycle. There shall be sufficient increment in the energy register to ensure the accuracy is better than 1/10 of the accuracy of the meter if the error is found to be more than the limits as specified in the Table 3.

On site testing of CTs and PT's shall be carried out using either by comparison with standard instrument transformers or by simulation techniques using appropriate test equipment. The connected burden shall be measured and recorded and shall be verified to ensure that it is commensurate with the rated burden of the instrument transformer.

NOTE — For reactive measurement, on-site accuracy test shall be by the injection test method using phantom load kit.

#### 12.2.2 Main, Check and Standby Meters

These shall be in accordance with *CEA (Installation and Operation of Meters) Regulations*.

### 12.3 Accuracy Requirements

#### 12.3.1 Under Reference Conditions

Limits of error specified in Table 2 are applicable for in-service meters when tested under reference conditions.

#### 12.3.2 On-site Conditions

Limits of error stated in Table 3 are applicable when in-service meters are tested on-site under specified operating conditions.

### 12.4 In-service Compliance Testing

It is an economical method of monitoring and determining whether a population of meters, installed in-service for a number of years without attendance, is continuing to operate in accordance with metrological specifications and other functional requirements. It is also to assign a performance indicator to the population so that appropriate asset management decisions can be taken. The results of in-service compliance testing shall be noted in the asset management register.

#### 12.4.1 Initial Life/Compliance Period

The initial life is determined in the design stage or in the prototype stage. This is done either from prediction of reliability from manufacturers' data of reliability of components submitted at the time of type approval or from accelerated life testing of a prototype.

If the initial life of a population is not certified for want of data or absence of a notified body, the meter service provider in the best interest of own asset management and the consumers, carries out initial in-service compliance testing after completion of two years in service so as to take care of any initial instability of performance. Generally, it is done in the 3rd year and the compliance period is reckoned from the initial year of service.

#### 12.4.2 On-going Compliance

After expiry of the initial life of meters of a particular type, it may be extended on the basis of test data collected from meters in the field or normally removed meters. The life is thus continuously monitored and it may be increased or decreased periodically depending on the data.

In the absence of such data or the notified body, the meter service provider shall carry out on-going in-service compliance tests after expiry of the initial compliance period, so as to assign a new compliance period.

**Table 2 In-service Limits of Errors and Uncertainties of Meter Test Equipment**

(Clause 12.3.1)

Sl No.	Accuracy Class	Type of Connection	Test Points	P.F.	Overall Uncertainty of Meter Test Equipment Percent	Limits of Error Percent
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2.0	Direct connected/With CTs	10 percent $I_b$ to $I_{Max}$	1.0	$\pm 0.4$	$\pm 2.0$
			0.5 lag		$\pm 0.6$	$\pm 2.0$
			0.8 lead		$\pm 0.6$	$\pm 2.0$
ii)	1.0/1.0S	Direct Connected/For CTs	5 percent $I_b$ to $I_{Max}$	1.0	$\pm 0.4$	$\pm 1.0$
			10 percent $I_b$	0.5 lag	$\pm 0.6$	$\pm 1.0$
			10 percent $I_b$	0.8 lead	$\pm 0.6$	$\pm 1.0$
iii)	0.5S	For CT/VTs	5 percent $I_b$ to $I_{Max}$	1.0	$\pm 0.1$	$\pm 0.5$
			10 percent $I_b$ to $I_{Max}$	0.5 lag	$\pm 0.12$	$\pm 0.6$
			10 percent $I_b$ to $I_{Max}$	0.8 lead	$\pm 0.12$	$\pm 0.6$

NOTE —  $\cos \Phi/\sin \Phi$  applicable for active/reactive energy respectively.**Table 3 In-service Maximum Permissible Errors and Uncertainties of Meter Test Equipment**

(Clause 12.3.2)

Sl No.	Accuracy Class	Test Points	P.F.	Overall Uncertainty of Meter Test Equipment (M.T.E.) Percent	Maximum Permissible Error (M.P.E.) Percent
(1)	(2)	(3)	(4)	(5)	(6)
i)	2.0	10 percent $I_b$ to $I_{Max}$	1.0 and 0.5 lag	$\pm 0.6$	$\pm 3.0$
ii)	1.0	10 percent $I_b$ to $I_{Max}$	1.0 and 0.5 lag	$\pm 0.4$	$\pm 2.5$
iii)	1.0S	5 percent $I_b$ to $I_{Max}$	1.0 and 0.5 lag	$\pm 0.3$	$\pm 2.0$
iv)	0.5S	5 percent $I_b$ to $I_{Max}$	1.0 and 0.5 lag	$\pm 0.2$	$\pm 1.0$

NOTE —  $\cos \Phi/\sin \Phi$  applicable for active/reactive energy respectively.

## 12.5 In-service Compliance — Installation Verification — Installation Audits

Installation audit is a periodic examination of the metering system installation to assess the health of the system and to ensure continued health of the same. All meter installations need to be periodically audited under a surveillance plan.

Various aspects to be observed during the audit are:

- Physical examination of the installation, its health in general and factors related to good installation practices like neatness of installation, mounting method, dressing of cables, colour coding of wires, ferruling including following common nomenclature in ferrules, integrity of the installation and its proneness to tampering, observations on safety aspects like bare connections, naked joints, earthing etc; and
- Detailed examination related to electrical nature like, correctness of connections, appropriateness of metering system

components and wires with respect to its application, meter enclosure authenticity of sealing system — both verification and security seals, type of enclosure used, number of seals used, whether number of seals is justified etc.

The energy service provider shall audit the installations on a periodic basis. Periodicity of the audit shall be defined as per the revenue potential of the metering system (that is, for high value consumers, it should be more frequent than to that of a domestic consumer). For LV direct connected consumers suitable statistical plan may be employed.

## 12.6 Implementation of Compliance Requirements

This Code will be notified by appropriate authority for implementation.

### 12.6.1 Existing Meters

The existing meters will be deemed to have the initial in-service compliance period as indicated in Table 4.

**Table 4 Deemed Initial Compliance Period of Meters In-service (During Implementation)**  
(Clause 12.6.1)

SI No.	Accuracy Class	Deemed Initial Compliance Period (Years)
(1)	(2)	(3)
i)	2.0 S	10
ii)	1.0/1.0 S	8
iii)	0.5 S	5

A population of meters which have outlived the deemed initial compliance period, will be tested for on-going compliance within 3 years from the year of implementation of this Code.

A population of meters which is within the deemed initial compliance period, will be tested for on-going in-service compliance within 1 year from the year of expiry of the deemed initial compliance period.

#### 12.6.2 New Meters

A population of new meters of any type will undergo compliance testing in the third year after being placed into service, in order to determine the initial in-service compliance period effective from the year of installations.

### 12.7 Methodology of In-service Compliance

Metrological characteristics and functional performance of meters under compliance requirements are tested. It is generally done on the basis of a sampling plan, with a selected no of test points and functional characteristics.

#### 12.7.1 Sampling Plan

12.7.2 Single sampling by attributes on the basis of normal distribution is adopted in the present Code.

#### 12.7.3 Population

Meters are to be grouped in a population based on:

- a) Manufacturer;
- b) Type;
- c) Year of installation;
- d) Geographic area;
- e) Overhead/Underground service;
- f) Indoor/Outdoor installation;
- g) Whether repaired; and
- h) Any other appropriate characteristic.

#### 12.7.4 Selection of Samples and Pass/Fail Criteria

Tables 1 and 2A given in IS 2500 (Part 1) will determine selection of samples and pass/fail criteria. Samples are to be selected at random on the basis of

standard random number generation table. Damaged/tampered meters are to be excluded from the population selected.

In case a population fails on the basis of single sampling, additional samples may be taken to arrive at conclusions on the basis of corresponding double samples as given in Table 3A of IS 2500 (Part 1).

If any on site test shows that the meter is outside the permissible error limits, investigation shall be made to determine if it is due to effect of influence quantities or the installation. The meter shall be tested in the laboratory and decision is to be based on results of laboratory testing.

Samples, if tested in a laboratory and found satisfactory, will be put back in service after evaluation.

#### 12.7.5 Evaluation

Testing will be done on site or under reference conditions to determine:

- a) Non-registration with voltage alone;
- b) Meter constant;
- c) Specific functional criteria;
- d) Metrological test points (minimum three);
- e) Compliance period will be determined on the basis of one of the methods to be selected by a meter service provider for its area of operation;
- f) Non-compliant population of meters will be removed from service within the period indicated in Table 5 or Table 6; and
- g) However, to arrive at the final decision for such a population, second sampling may be carried out as per Table 3A of IS 2500 (Part 1) and overall pass/fail decisions may be taken accordingly.

##### 12.7.5.1 Variable error-band method (constant AQL)

Table 5 gives accuracy class wise different initial and on-going compliance periods to be assigned on the basis of variable error-bands at fixed AQL.

##### 12.7.5.2 Variable AQL method (constant error-band)

Table 6 gives accuracy class wise different initial and on-going compliance periods to be assigned on the basis of variable AQL for class-index error-bands.

### 12.8 Meter Test Equipment (M.T.E.) Standards and Periodicity of Calibration

For the purpose of dependable and effective calibration and metrological verification by a meter service provider, the latter will properly maintain calibrated

**Table 5 Initial and On-going Compliance Period of Meters In-service  
(After Implementation by Fixed AQL Method)**  
(Clauses 12.7.5 and 12.7.5.1)

Sl No.	Accuracy Class	Error-Bands in Class Index Load and P.F. Range	In-service Compliance Period (Years)	
			Initial (AQL = 1)	On-going (AQL = 4)
(1)	(2)	(3)	(4)	(5)
i)	2.0	±2.0	10	5
ii)		±2.5	7	4
iii)		±3.0	4	2
iv)		±4.0	To remove within 2 years	To remove within 2 years
v)	1.0/1.0 S	±1.0	8	4
vi)		±1.5	5	3
vii)		±2.0	3	2
viii)		±3.0	To remove within 2 years	To remove within 2 years
ix)	0.5 S	±0.5	6	3
x)		±0.75	4	2
xi)		±1.0	2	1
xii)		±1.5	To remove within 1 year	To remove within 1 year

**Table 6 Initial and On-going Compliance Period of Meters In-service  
(After Implementation by Fixed Error Band Method)**  
(Clauses 12.7.5 and 12.7.5.2)

Sl No.	Accuracy Class	AQL for the Class Index Error Band	In-service Compliance Period (Years)	
			Initial	On-going
(1)	(2)	(3)	(4)	(5)
i)	2.0	1.0	10	—
ii)		2.5	7	5
iii)		4.0	4	4
iv)		6.5	To remove within 2 years	2
v)		10	—	To remove within 2 years
vi)	1.0/1.0 S	1.0	8	—
vii)		2.5	5	4
viii)		4.0	3	3
ix)		6.5	To remove within 2 years	2
x)		10	—	To remove within 2 years
xi)	0.5 S	1.0	6	—
xii)		2.5	4	3
xiii)		4.0	2	2
xiv)		6.5	To remove within 1 year	1
xv)		10	—	To remove within 1 year

standards in its meter testing station. The accuracy class of meter test equipment shall be as follows:

Accuracy Class of Meter Under Test	Accuracy Class of Meter Test Equipment
(1)	(2)
2.0 S	0.3
1.0/1.0 S	0.2
0.5 S	0.1

Various standards and their periodicity of calibration are shown in Table 7.

When a working standard is calibrated and is found to

be partially complying to its specification, the use of the working standard shall be restricted to working range and class only. When a working standard is calibrated and is found to be outside its specification, its use shall be immediately stopped. The reason shall be investigated and the occurrence reported within 3 working days of its discovery. Notification shall be given of the details and results of the investigation. The result of the investigation shows:

- Whether metering equipment calibrated or tested using that working standard since its last satisfactory calibration complies with the relevant standard document; and

**Table 7 Periodicity of Calibration of Various Standards of a Meter Test Station**

(Clause 12.8)

Sl No.	Energy Standards (Maintained in M.T.S.)	Calibration Interval (Months)		Remarks
		Normal	Extended	
(1)	(2)	(3)	(4)	(5)
i)	Reference standard (External calibration only)	24	—	Stability to be monitored
ii)	ac/dc transfer standard (External calibration)	24	60	Depending on stability
iii)	ac/dc transfer standard (In-house calibration)	Prior to use	6	Depending on stability
iv)	ac transfer standard (When used in-house)	2	6	Depending on stability
v)	ac transfer standard (When used on-site)	Before and after use	—	—
vi)	Working standard (Optional external calibration)	12	—	—
vii)	Working standard (In-house calibration)	2	6	Depending on stability

b) The reason why that working standard is outside its specification.

- 1) *Location* — It does not require the Standards of any meter operator agent to be maintained or used at any one location, and
- 2) *Mobility* — Reference standards and ac/dc transfer standards shall not be mobile standards and shall remain in one location as far as possible and only be moved for verification at an accredited laboratory.

NOTE — ac transfer standards and working standards may be mobile standards.

Table 5 or Table 6 for on-going compliance requirements.

## 15 DISPOSAL

Meters shall be systematically disposed off at the end of their useful life, on obsolescence or when declared irreparable/uneconomical to repair during its service life. Such meters shall be scrapped and disposed off taking care that no part is left in re-usable or recyclable form. It shall be ensured that meter identification plates/labels are destroyed and recorded into the asset management system. Special disposal actions, as applicable, shall be adopted for hazardous material/components like lithium batteries, magnets, lead containing parts, etc.

## 16 ASSET AND SEAL MANAGEMENT SYSTEM

### 16.1 Asset Management

An asset management system shall be maintained for keeping records in order to ensure that the life cycle history of meters is traceable from the point of first installation. The details of the consumer number/consumer name and address against which the meters are issued shall be maintained in the stores and the meters shall only be issued against the consumer number/consumer name issued from the stores.

The register shall contain information on meter serial number, energy service provider assigned serial number, procurement reference (for example, purchase order number), sealing details, manufacturer's name, year of manufacture, type of meter, meter constant, accuracy class, current rating, installation site reference and date of installation, test results or reference to test results (accuracy test, dial test), initial reading, information about auxiliary equipment like CT/VT and their ratings. The asset register should preferably be in electronic form with features of traceability of the history of the metering installation.

## 13 REPAIR

At the end of useful life considering all the extensions, or at the end of in-service compliance period, a meter is removed. The next action is either refurbishment/repair in a workshop belonging to the service provider, manufacturer or a third party. Otherwise it may be disposed off.

The decision taken is centered on economical considerations involving:

- a) Remaining useful life after repair;
- b) Cost of repair; and
- c) Asset disposal value.

## 14 RE-CERTIFICATION/RE-VERIFICATION/IN-SERVICE RE-COMPLIANCE

After refurbishment/repair of meters removed from service, it is required as a good practice that these are:

- a) Re-certified by the notified body for the remaining portion of useful life;
- b) Re-verified by the notified body and the seals applied; and
- c) Inspected for in-service re-compliance testing and re-compliance period determined as per

Status of initial and on-going compliance should be indicated in the register with reference to test data of the samples.

Records of returned meter are also to be maintained. All the details of old meters are to be entered in the register when the old meter comes to the store.

#### **16.2 Seal Management**

The energy service provider shall maintain an appropriate seal management system. The seal management system ensures that seals are secure, controlled, uniquely identified and traceable.

A seal management system shall ensure the following:

- a) Seals are unique and distinctive for each manufacturer/energy service provider;
- b) Seals are not easily imitable;

- c) Seals when removed, leave detectable evidence;
- d) Procurement, stocking, issue, installation and disposal of seals is traceable;
- e) Traceability should be uniquely identifiable to a responsible individual;
- f) All numbered seals are traceable to consumers through meter numbers;
- g) Seals are secured against misuse;
- h) Sealing punch, when used shall be uniquely identifiable and traceable; and
- j) Seal Management system itself is secure with proper access control.

All numbered seals should be traceable to consumers through meter numbers. All broken seals shall be disposed off taking care that the seals are destroyed so that they cannot be re-used. Proper records of such disposal shall be maintained.

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